



CLINICAL REPORT

Attention-Deficit/Hyperactivity Disorder and Substance Abuse

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KEY WORDS

ADHD, attention-deficit/hyperactivity disorder, nonstimulant medication, safe prescribing, stimulant medication, substance abuse

ABBREVIATIONS

AAP—American Academy of Pediatrics

ADHD—attention-deficit/hyperactivity disorder

DSM-5—*Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*

OR—odds ratio

SUD—substance use disorder

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

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Attention-deficit/hyperactivity disorder (ADHD) and substance use disorders are inextricably intertwined. Children with ADHD are more likely than peers to develop substance use disorders. Treatment with stimulants may reduce the risk of substance use disorders, but stimulants are a class of medication with significant abuse and diversion potential. The objectives of this clinical report were to present practical strategies for reducing the risk of substance use disorders in patients with ADHD and suggestions for safe stimulant prescribing. *Pediatrics* 2014;134:e293–e301

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is the most common neurobehavioral disorder of childhood and occurs in approximately 8% of children and youth.^{1,2} It is characterized by deficits in attention in addition to hyperactivity and impulsivity that cause functional impairment in at least 2 settings.³ ADHD is considered a chronic condition.⁴ Stimulant medication is recommended as first-line therapy for school-aged children with ADHD, with implementation of behavioral therapy also recommended. Children with ADHD are at high risk of having co-occurring mental health and behavioral problems, including substance use disorders (SUDs).^{5,6} It is not clear whether stimulant treatment reduces the risk of SUDs in adolescents with ADHD. Some epidemiologic studies have found an inverse association between stimulant treatment and SUDs,^{7,8} although this association was not found in a study that examined the relationship between ADHD, stimulant medication, and conduct disorder.^{9,10} Stimulant medication can also have significant potential for misuse,¹¹ abuse, and diversion^{12,13} (ie, giving away, trading, or selling of prescription medication), which complicates care. Although the potential for misuse and diversion of stimulants has been studied,^{11,12} there is a paucity of recent research on the abuse potential of stimulants among children and adolescents. The objectives of the present clinical report were to review the literature and provide practical suggestions for optimizing ADHD care while minimizing misuse, abuse, and diversion of stimulant medication.

EPIDEMIOLOGY OF SUDS AMONG INDIVIDUALS WITH ADHD

Children and adolescents with ADHD are more likely to misuse alcohol, tobacco, and other illicit substances compared with children without ADHD.^{14,15} In a 2011 meta-analytic review of the prospective association of childhood ADHD and substance use, Lee et al¹⁴ included 27 longitudinal studies that followed up children with and without ADHD into adolescence or adulthood. The following demographic/methodologic factors did not significantly moderate the associations between childhood ADHD and substance outcomes: gender, age, race, publication year, sample source, version of the *Diagnostic and Statistical Manual of Mental Disorders* used to diagnose ADHD, family history of SUD, cognitive impairment, executive dysfunction, and family environment.¹⁶ Lee et al reported that, compared with control subjects without ADHD, children with ADHD were:

- twice as likely to have a lifetime history of nicotine use (odds ratio [OR]: 2.08, $P < .001$);
- nearly 3 times more likely to report nicotine dependence in adolescence/adulthood (OR: 2.82, $P < .001$);
- almost 2 times more likely to meet diagnostic criteria for alcohol abuse or dependence (OR: 1.74, $P < .001$);
- approximately 1.5 times more likely to meet criteria for marijuana use disorder (OR: 1.58, $P = .003$);
- twice as likely to develop cocaine abuse or dependence (OR: 2.05, $P < .001$); and
- more than 2.5 times more likely to develop an SUD overall.

ADHD is associated with an earlier age at onset of substance use and a higher likelihood of use of a variety of substances.^{17–19} Brook et al²⁰ reported that the diagnosis of ADHD poses an increased risk of SUD into adulthood;

meeting criteria for a diagnosis of ADHD in adolescence is associated with developing SUDs in a subject's 20s and 30s. Among individuals with ADHD, the number of inattention and hyperactivity/impulsivity symptoms exhibited is positively correlated with risk of substance use.²¹ Debate exists regarding whether the inattentive versus hyperactive/impulsive subtypes of ADHD confer different risk.^{22–26}

EXPLORING THE BIOLOGICAL AND ENVIRONMENTAL BASIS OF THE RELATIONSHIP BETWEEN ADHD AND SUD

To date, the mechanisms underlying the association between ADHD and SUDs are not completely understood, although several theories have been proposed. Impulsivity is associated with an increased risk of substance use,²⁷ a prerequisite for developing an SUD. It is also possible that impulsivity and poor judgment associated with ADHD contribute to the development of SUDs.²⁸ However, executive functioning deficits and increased substance use seem to be only one piece of the puzzle.²⁹ In addition to difficulty with executive functioning and poor judgment, which may lead to trying substances, individuals with ADHD may also be biologically more vulnerable to developing addiction than their peers without ADHD.

Dopamine transmission is central to current models of both ADHD and SUDs.^{30–32} Compared with unaffected control subjects, individuals with ADHD have greater dopamine transporter density, which may result in rapid clearance and low levels of synaptic dopamine.³³ Drugs of abuse, including cocaine, amphetamine, methamphetamine, Ecstasy, nicotine, alcohol, opiates, and marijuana, all increase synaptic dopamine concentrations, most notably in the brain's reward center, the nucleus accumbens.³⁴

Stimulant medications manage ADHD symptoms by increasing synaptic dopamine concentrations in the striatum (which includes the nucleus accumbens) via presynaptic transporters.³⁵ Theoretically, some individuals with ADHD may use substances to increase synaptic dopamine concentrations as a form of self-medication.³⁶ Another theory proposes a common genetic factor underlying both ADHD and risk of SUDs, although more studies are needed to further evaluate this association.^{37,38}

Children and adolescents with ADHD have higher rates of grade retention and school dropout than those without ADHD.^{39,40} These academic failures may increase an individual's likelihood to use drugs as a means to escape anxiety about school.⁴¹ Academic failures may also cause changes in peer groups, placing the individual with ADHD in social settings with others who have experienced school problems and are at a higher risk of alcohol and drug use.^{42,43}

TREATING ADHD AND CO-OCCURRING MENTAL HEALTH DISORDERS TO REDUCE THE RISK OF SUDS

Treatment of ADHD May Reduce the Risk of SUDs

Treatment of ADHD symptoms with stimulant medication may reduce the risk of developing SUDs.^{7,44} Biederman et al⁴⁵ determined that pharmacotherapy was associated with an 85% reduction in risk of SUDs in youth with ADHD. Timing of treatment matters: children with ADHD who are treated with stimulant medication at a younger age are less likely to use substances than those who have delayed onset of treatment.⁴⁶ Behavioral therapy may also confer some protection against substance use. Findings from the Multimodal Treatment Study of Children with ADHD revealed that

behavioral interventions afforded protection from SUDs at 24 months' post-intervention but not at 36 months.⁴⁷ The optimal age at which to begin treatment of ADHD to decrease the risk of substance use has not been established. The American Academy of Pediatrics (AAP), in its clinical practice guidelines for ADHD,⁴ recommends treating ADHD symptoms in children 6 years and older by using both behavioral interventions and medications approved by the US Food and Drug Administration. The AAP recommends that ADHD symptoms in children as young as 4 years be treated with behavioral interventions and possibly medications. In this context, treatment of ADHD symptoms is recommended as soon as the diagnosis of ADHD is made. Symptoms of ADHD often persist into adulthood,^{48,49} although optimal duration of medication treatment has not been established. Maintaining children on medication while symptoms persist and monitoring for adverse effects seems to be a reasonable approach.

As noted in the AAP clinical practice guidelines for ADHD,⁴ at any point at which a clinician believes that he or she is not adequately trained or is uncertain about making a diagnosis or continuing with treatment, a referral to a pediatric or mental health subspecialist should be made. If a diagnosis of ADHD or other condition is made by a subspecialist, the primary care clinician should develop a management strategy with the subspecialist which ensures that the child will continue to receive appropriate care consistent with a medical home model wherein the primary care clinician partners with parents so that both health and mental health needs are integrated.

Treating Co-occurring Mental Health Disorders

Co-occurring mental health conditions are common in individuals with ADHD and are associated with increased SUD

risk. Brook et al²⁰ determined that conduct disorder mediated the association of ADHD and SUDs. Other studies have revealed that, even after controlling for conduct disorder, ADHD symptoms are associated with increased risk of both substance use and development of SUDs.^{18,25} Comorbid conditions, including depression, anxiety, and low self-esteem, have each been noted to confer increased risk of substance use in individuals with ADHD.^{5,17,25,50,51} These findings suggest that diagnosing and treating co-occurring conditions in individuals with ADHD may help to reduce the risk of developing SUDs.

STIMULANT MEDICATIONS

Stimulant medications are highly effective for children and adolescents in reducing the core symptoms of ADHD.⁵² The most commonly used preparations of stimulant medication are methylphenidate and amphetamine. Atomoxetine, a selective norepinephrine reuptake inhibitor, and long-acting guanfacine and clonidine, which are selective α_2 -adrenergic agonists, are also recommended for the management of some ADHD symptoms.⁴ However, the effect sizes (meaning likelihood of reducing ADHD symptoms compared with placebo) are lower for atomoxetine and long-acting guanfacine and clonidine than they are for the stimulant medications.

Stimulant medications are both more effective at treating ADHD symptoms⁵³ and much more commonly misused than nonstimulant medications. Pediatricians are thus in a position to prescribe a medication that can reduce both ADHD symptoms and the risk of developing an SUD and simultaneously pose a risk for abuse and diversion. An understanding of the factors associated with misuse, abuse, and diversion of stimulant medication may help to guide safe use. Table 1 lists the most commonly

used medications for ADHD and their suspected relative abuse potential.

The terms "misuse," "diversion," and "abuse" are all associated with improper use of medication, but they are different phenomena with different definitions. The term misuse includes the use of medications not prescribed to the individual and using medications in ways other than prescribed. Examples of misuse include taking larger or more frequent doses than prescribed or using someone else's medication to enhance performance.¹³ The most common reasons reported for stimulant misuse are to concentrate, study, and improve grades; "to party" and "get high"; and to experiment.^{54–57} Most individuals who misuse stimulant medications do so via oral administration, with intranasal insufflation ("snorting") less common.^{43,46} Adolescents who report snorting medications or using stimulants to "get high" may be at highest risk of stimulant abuse and dependence.⁵⁸ The term diversion means the transfer of medication from the person to whom it is prescribed to a person for whom it is not prescribed.¹³ The term substance abuse was used in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*, to refer to use associated with problems or risk that interfere with functioning. The term addiction refers to loss of control or compulsive use of a substance. In the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5), diagnostic terms were changed to SUD, mild/moderate/severe, depending on the number of positive criteria.³ Even though they are not formal diagnoses, the terms substance abuse and addiction will likely remain in the lexicon and retain their meaning for some time, particularly in reference to prescription medications.

TABLE 1 List of Most Commonly Used Medications for ADHD With Suspected Relative Abuse Potential

Stimulant Status	Medication Type	US Trade Name ^a	Suspected Relative Abuse Potential ^b	
Stimulants				
Short-acting/immediate release	Methylphenidate	Ritalin ^a	High	
		Methylin ^a	High	
	Dexamethylphenidate	Focalin ^a	High	
		Amphetamine-dextroamphetamine	Adderall ^a	High
	Dextroamphetamine	Dexedrine	High	
		DextroStat ^a	High	
		ProCentra	High	
		Metadate CD	Medium	
	LA/ER	Methylphenidate	Metadate ER ^a	Medium
			Ritalin LA ^a	Medium
Ritalin SR ^a		Methylin ER	Medium	
		Daytrana patch	Low	
Concerta ^a		Quillivant XR	Low	
		Focalin XR	Low	
Dexamethylphenidate		Dexedrine Spansule ^a	Medium	
Dextroamphetamine		Adderall XR ^a	Medium	
Amphetamine-dextroamphetamine				
Lisdexamfetamine		Vyvanse	Low	
Nonstimulants				
α_2 -adrenergic agonists	Guanfacine	Intuniv	Low	
	Clonidine	Kapvay	Low	
Selective norepinephrine reuptake inhibitor	Atomoxetine	Strattera	Low	

CR, controlled release; ER, extended release; LA, long acting; XR, extended release; SR, sustained release.

^a Indicates that generic formulation is available.

^b Relative abuse potential is suspected based on length of action and formulation of medication.

Misuse of Stimulant Medications

Misuse and diversion of stimulant medications are more widespread problems than abuse or addiction.⁵⁹ Wilens et al⁵⁴ conducted a systematic review of the literature examining misuse and diversion of prescription ADHD medications. Of the 21 studies reviewed, rates of past-year non-prescribed stimulant use ranged from 5% to 9% in grade school and high school children and from 5% to 35% in college-aged individuals. In a large public university in the mid-Atlantic region, Arria et al⁵⁵ found that 18% of students who were not prescribed stimulants engaged in nonmedical stimulant use, more than one-quarter (26.7%) of students with diagnosed ADHD reported having used more medications than prescribed, and 15.6% reported using someone else's

prescription stimulants in their lifetime. Nonmedical use of prescription stimulants was associated with previous use of illicit substances as well as alcohol and marijuana dependence.

Diversion of Stimulant Medications

Diversion of stimulant medication is common. Between 16% and 23% of school-aged children reported that they have been approached to sell, give, or trade their prescription stimulant medication.^{60,61} Boys are more likely to divert their stimulant medications than girls.⁶² The most common source of diverted medications is friends and family members.⁶³ More than one-quarter of university students reported that diverted stimulant medications are easy or somewhat easy to obtain.⁵⁶ Individuals with ADHD who have co-occurring SUDs and/or conduct

disorders are more likely to both misuse and divert their stimulant medication,⁶⁴ as are white individuals, members of fraternities and sororities, and students with lower grade-point averages.^{54,65}

Abuse of Stimulant Medications

Methylphenidate and amphetamine both have known abuse potential, although there is little evidence that these drugs are widely abused by the patients to whom they are prescribed,⁵⁹ and evidence for abuse potential among children and adolescents is limited. "Subjective effect" (ie, how much a person likes a drug, achieves euphoria, experiences reinforcement with use) is an important factor considered in determining abuse potential of a substance. Among individuals without ADHD, both methylphenidate and amphetamine produce significant subjective effects; amphetamine is nearly twice as potent as methylphenidate at equivalent doses.⁶⁶ Research performed in the 1970s revealed that stimulants do not reliably produce these subjective effects in individuals with ADHD.⁶⁷ Fredericks and Kollins⁶⁸ found that individuals with ADHD displayed a higher preference for methylphenidate compared with placebo, although other measures of abuse potential, specifically participant-rated effects of methylphenidate on mood, were not elevated. Thus, the preference for methylphenidate may reflect its therapeutic efficacy rather than abuse potential. Most of the studies evaluating abuse potential of stimulant medications used short-acting preparations, and there is evidence that sustained-release and longer acting preparations have decreased abuse potential.^{59,69} Indeed, short-acting medications are more likely to be misused or abused, and amphetamine preparations are misused and abused more frequently than methylphenidate preparations.^{53,70,71}

SAFE STIMULANT-PRESCRIBING PRACTICES

In light of the high risk of SUDs among individuals with ADHD, pediatricians should seek to accurately diagnose ADHD and treat symptoms appropriately. Several precautions may help to reduce stimulant misuse, abuse, and diversion.

Before Prescribing, Confirm a Diagnosis of ADHD

Inattention is multifactorial. Many children or adolescents who are depressed, anxious, neglected, or having academic difficulty because of a learning disorder may present as inattentive. ADHD is a primary disorder of attention. According to the diagnostic criteria for ADHD in the DSM-5,³ ADHD symptoms must be present during childhood; thus, particular caution is warranted before making a new diagnosis of ADHD, especially in an adolescent. Although it is possible that symptoms in childhood were unnoticed, adolescents sometimes attempt to get a stimulant prescription by feigning symptoms of ADHD.⁷² The diagnosis of ADHD is made clinically in an individual who fulfills the criteria for ADHD listed in the DSM-5.³ Standardized tools, such as parent- and teacher-completed ADHD rating scales, assist in making a diagnosis and should be used in the assessment.⁷³ A thorough history, review of medical and school records, and a collateral parent interview may all help confirm a correct diagnosis. The criteria used for diagnosing ADHD and any history or evaluations that were made to rule out other conditions that might be confused with ADHD (eg, sleep disturbances, other learning disabilities, thyroid dysfunction) should be recorded in the patient's medical record. The AAP's Clinical Practice Guideline for ADHD provides specific guidance about diagnosis and management.⁴

Screen Older Children and Adolescents for Use of Alcohol, Marijuana, and Other Drugs

The AAP recommends screening, brief intervention, and referral to treatment as part of routine health care for older children and adolescents.⁷⁴ This recommendation is particularly important for adolescents with ADHD, who are more likely to use substances and to develop an SUD than their peers. Adolescents with ADHD who use alcohol, marijuana, or other substances are also more likely to divert stimulant medication and thus require increased attention and monitoring by their prescriber.

The AAP policy statement titled "Substance Use: Screening, Brief Intervention, and Referral to Treatment for Pediatricians"⁷⁴ provides a complete review of recommended screening tools and brief interventions for adolescent substance use. The AAP currently recommends the 3 "opening questions" associated with the CRAFFT tool (see the following text) to detect past-year substance use. Although currently an active area of National Institutes of Health–funded research,^{75,76} these questions have not been validated to date, and it is not known whether the "other drugs" question is sensitive enough for identifying misuse or abuse of prescription medications. An additional question (eg, "Have you ever used someone else's prescribed medication?") may be warranted to identify misuse, particularly before prescribing a stimulant medication for the first time.

"Opening questions" to identify past-year substance use:

In the past year, have you:

1. Had a drink with alcohol in it?
2. Used marijuana?
3. Used any other substance to get high?

Provide Anticipatory Guidance

Anticipatory guidance regarding proper use of stimulant medications should be part of every patient encounter in which medications for ADHD are discussed. Table 2 lists points that should be included in this discussion. The pediatrician should discuss that medications should only be taken as prescribed by the physician, even with very young children, in a developmentally appropriate manner. As children enter the upper elementary school years, the conversation should evolve to include discussion about the proper use of medication. Children and parents should be aware of the risk for misuse, diversion, and abuse. Children should understand that trading or selling stimulant medication is illegal. Children who live in areas of high-crime rates should have a concrete, realistic safety plan for managing their medication. For children who are 12 years and older, the discussion should also include information about careful transitioning of administration of medication. Although the child should not be pushed to start self-administering medication, having this discussion earlier with the family can alert them that transition of medication management from caregiver to child should be a gradual and carefully monitored one so that when the child is developmentally ready to assume more responsibility of medication management, there is a plan in place to ensure that the transition is safe.

Document Prescription Records

Stimulant medication is a Drug Enforcement Administration Class II controlled substance. Every prescriber must document and monitor the prescribing of stimulant medications. Requests for early refills should be explored and carefully documented to

TABLE 2 Discussion Points for Anticipatory Guidance Regarding Stimulants and Substance Use

Proper administration

At each clinic visit, review with the patient how he or she is taking his or her stimulant medication.

- Only take the amount of medicine prescribed. Do not take extra medication.
- Take your stimulant medication exactly as prescribed. Do not change the dose or timing. Speak to your doctor if you do not think your medication is working as it should or if you are experiencing adverse effects.
- Do not use alcohol, tobacco, marijuana, or other illicit substances. Drug use worsens problems with attention, leads to medication noncompliance, and can interact with stimulant medication.
- If stimulant medication is administered at school, it should be dispensed at school nurse's office or other safe location with adult supervision.

Risk of misuse, diversion, and abuse

For people who do have ADHD, when stimulant medications are taken as prescribed, there is no increased risk of abuse; rather, stimulant medication appears to decrease the risk of developing an SUD.

- Explain that some people who do not have ADHD may take stimulant medications inappropriately.
- Inform patient and parent that children and adolescents may be asked to give away or sell their stimulant medications but should never do so. Parents may role play appropriate responses so that the child will be prepared if asked. Have the patient and parents keep medication in a safe location (either at home or in a locked office at school). Medications should never be carried in a backpack or purse.

Transition of care

Transitioning of administration of stimulant medication from caregiver to child/adolescent should be done incrementally. Parents and patients should be counseled that ADHD generally persists into adulthood.

- To start a transition, the child/adolescent must be able to remember to take medication as prescribed. Signs suggesting readiness should include the ability to name the medication, dose, and timing of administration as well as emerging signs of independence in other areas, such as being home alone, carrying a key, completing homework independently, or participating in care for a pet.
- The caregiver should continue to periodically supervise medication administration and monitor the child's/adolescent's overall school, social, and family functioning. Weekly pill dispensers can allow burgeoning autonomy for the child/adolescent while allowing the caregiver to monitor doses and control the supply.
- If concerns develop regarding medication misuse or diversion or use of other drugs, the parent should resume control of the medication, dispense each dose, and monitor carefully.

detect a pattern of frequent early requests. Similarly, it is important to document communications between multiple providers who share responsibilities for prescribing medications or altering treatment regimens for the same patient.

Prescribing Medications for ADHD in Context of Active SUD

Illicit substance use often results in attention difficulties, hyperactivity, and/or impulsivity, making a new diagnosis of ADHD difficult or impossible to distinguish from symptoms related to ongoing substance use. In these cases, reevaluation after a period of abstinence may be warranted.

Adolescents who have both previously diagnosed ADHD and an active SUD may be difficult to monitor because

symptoms of substance use may be indistinguishable from ADHD symptoms. In general, an active SUD should be treated (usually via referral to a mental health counselor or addiction specialist) before beginning medication to treat ADHD. However, for patients with well-documented ADHD that predates the onset of substance use, it may be reasonable to treat both disorders concurrently. Consultation with a psychiatrist or addiction specialist when managing complex patients is suggested.

When considering which ADHD medication to prescribe to a patient with a co-occurring SUD, a careful risk/benefit assessment must be conducted. If the patient is currently abusing prescription stimulants or there is a clear indication that the patient would sell or divert stimulant

medication, it may be best to start with a long-acting stimulant medication with low risk of misuse or diversion. Long-acting preparations, especially those with an osmotic controlled-release oral delivery system such as Concerta, have lesser likelihood of misuse or diversion.⁷⁷ It is also reasonable to consider use of a non-stimulant preparation,⁷⁸ even though nonstimulant medications are less efficacious than stimulants.⁷⁹ The prodrug formulation of dextroamphetamine, lisdexamfetamine, has a lower abuse potential than other stimulants and thus may be considered.^{80,81} However, physicians should be aware that any psychoactive medication can be misused. As for all patients, it is important to carefully monitor medication adherence.

A special circumstance occurs when a pediatrician prescribes stimulant medications for college students and older patients living away from home. A treatment plan should document how medication will be prescribed and how frequently the patient is expected to return for follow-up visits with the pediatrician. Medication administration by a student health staff member or keeping medications in a small medication safe may reduce diversion or theft. Follow-up visits should include self-report of medication efficacy, adverse effects (appetite, abdominal symptoms, headaches, and sleep disturbance) and screening for medication misuse, abuse, or diversion. The patient's responses should be documented in the medical record. Reports or suggestions of new physical or mental health symptoms require reevaluation.

SUMMARY

ADHD is a common neurobehavioral disorder of childhood, and individuals with ADHD are more likely to misuse alcohol, tobacco, and other illicit

substances compared with children and adolescents without ADHD. Individuals with ADHD and co-occurring mental health conditions, such as disruptive behavior disorders or depression, are at even higher risk of developing SUDs. Appropriate treatment of ADHD symptoms with medication and behavior therapy may reduce the risk of development of SUDs. Primary care providers should seek to identify and treat ADHD to prevent the development of SUDs. However, the recommended first-line medication therapy for ADHD is stimulant medications, which themselves pose a risk of misuse, diversion, and abuse. Therefore, an important part of ADHD treatment and stimulant medication management

includes screening for SUDs and providing anticipatory guidance around the appropriate and safe use of stimulant medications. Individuals with co-occurring ADHD and active SUDs require a careful, individual risk/benefit assessment regarding the safety of prescribing a stimulant medication. Longer acting preparations of stimulant medication, the prodrug formulation of dextroamphetamine, and non-stimulant medications for ADHD all have lower abuse potential than short-acting preparations of stimulant medication and, thus, their use should be strongly considered if there is a high risk of misuse, diversion, or abuse of stimulant medications.

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REFERENCES

- Barbareisi W, Katusic S, Colligan R, et al. How common is attention-deficit/hyperactivity disorder? Towards resolution of the controversy: results from a population-based study. *Acta Paediatr Suppl.* 2004;93(445):55–59
- Centers for Disease Control and Prevention (CDC). Increasing prevalence of parent-reported attention-deficit/hyperactivity disorder among children—United States, 2003 and 2007. *MMWR Morb Mortal Wkly Rep.* 2010;59(44):1439–1443
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5)*. Arlington, VA: American Psychiatric Publishing; 2013
- Wolraich M, Brown L, Brown RT, et al; Subcommittee on Attention-Deficit/Hyperactivity Disorder; Steering Committee on Quality Improvement and Management. ADHD: clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics.* 2011;128(5):1007–1022
- Yoshimasu K, Barbareisi WJ, Colligan RC, et al. Childhood ADHD is strongly associated with a broad range of psychiatric disorders during adolescence: a population-based birth cohort study. *J Child Psychol Psychiatry.* 2012;53(10):1036–1043
- Larson K, Russ SA, Kahn RS, Halfon N. Patterns of comorbidity, functioning, and service use for US children with ADHD, 2007. *Pediatrics.* 2011;127(3):462–470
- Katusic SK, Barbareisi WJ, Colligan RC, Weaver AL, Leibson CL, Jacobsen SJ. Psychostimulant treatment and risk for substance abuse among young adults with a history of attention-deficit/hyperactivity disorder: a population-based, birth cohort study. *J Child Adolesc Psychopharmacol.* 2005;15(5):764–776
- Wilens TE, Faraone SV, Biederman J, Gunawardene S. Does stimulant therapy of attention-deficit/hyperactivity disorder beget later substance abuse? A meta-analytic review of the literature. *Pediatrics.* 2003;111(1):179–185
- Molina BS, Hinshaw SP, Eugene Arnold L, et al; MTA Cooperative Group. Adolescent substance use in the multimodal treatment study of attention-deficit/hyperactivity disorder (ADHD) (MTA) as a function of childhood ADHD, random assignment to childhood treatments, and subsequent medication. *J Am Acad Child Adolesc Psychiatry.* 2013;52(3):250–263
- Harty SC, Ivanov I, Newcorn JH, Halperin JM. The impact of conduct disorder and stimulant medication on later substance use in an ethnically diverse sample of individuals with attention-deficit/hyperactivity disorder in childhood. *J Child Adolesc Psychopharmacol.* 2011;21(4):331–339
- Sepúlveda DR, Thomas LM, McCabe SE, Cranford JA, Boyd CJ, Teter CJ. Misuse of prescribed stimulant medication for ADHD and associated patterns of substance use: preliminary analysis among college students. *J Pharm Pract.* 2011;24(6):551–560
- Rabiner DL. Stimulant prescription cautions: addressing misuse, diversion and malingering. *Curr Psychiatry Rep.* 2013;15(7):375
- Kaye S, Darke S. The diversion and misuse of pharmaceutical stimulants: what do we know and why should we care? *Addiction.* 2012;107(3):467–477
- Lee SS, Humphreys KL, Flory K, Liu R, Glass K. Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: a meta-analytic review. *Clin Psychol Rev.* 2011;31(3):328–341
- Molina BS, Flory K, Hinshaw SP, et al. Delinquent behavior and emerging substance use in the MTA at 36 months: prevalence, course, and treatment effects. *J Am Acad Child Adolesc Psychiatry.* 2007;46(8):1028–1040

16. Wilens TE, Morrison NR. Substance-use disorders in adolescents and adults with ADHD: focus on treatment. *Neuropsychiatry (London)*. 2012;2(4):301–312
17. Horner BR, Scheibe KE. Prevalence and implications of attention-deficit hyperactivity disorder among adolescents in treatment for substance abuse. *J Am Acad Child Adolesc Psychiatry*. 1997;36(1):30–36
18. Arias AJ, Gelernter J, Chan G, et al. Correlates of co-occurring ADHD in drug-dependent subjects: prevalence and features of substance dependence and psychiatric disorders. *Addict Behav*. 2008;33(9):1199–1207
19. Wilens TE, Martelon M, Joshi G, et al. Does ADHD predict substance-use disorders? A 10-year follow-up study of young adults with ADHD. *J Am Acad Child Adolesc Psychiatry*. 2011;50(6):543–553
20. Brook DW, Brook JS, Zhang C, Koppel J. Association between attention-deficit/hyperactivity disorder in adolescence and substance use disorders in adulthood. *Arch Pediatr Adolesc Med*. 2010;164(10):930–934
21. Gudjonsson GH, Sigurdsson JF, Sigfusdottir ID, Young S. An epidemiological study of ADHD symptoms among young persons and the relationship with cigarette smoking, alcohol consumption and illicit drug use. *J Child Psychol Psychiatry*. 2012;53(3):304–312
22. Ernst M, Luckenbaugh DA, Moolchan ET, et al. Behavioral predictors of substance-use initiation in adolescents with and without attention-deficit/hyperactivity disorder. *Pediatrics*. 2006;117(6):2030–2039
23. Chang Z, Lichtenstein P, Larsson H. The effects of childhood ADHD symptoms on early-onset substance use: a Swedish twin study. *J Abnorm Child Psychol*. 2012;40(3):425–435
24. Tamm L, Adinoff B, Nakonezny PA, Winhusen T, Riggs P. Attention-deficit/hyperactivity disorder subtypes in adolescents with comorbid substance-use disorder. *Am J Drug Alcohol Abuse*. 2012;38(1):93–100
25. Glass K, Flory K. Are symptoms of ADHD related to substance use among college students? *Psychol Addict Behav*. 2012;26(1):124–132
26. Molina BS, Pelham WE Jr. Childhood predictors of adolescent substance use in a longitudinal study of children with ADHD. *J Abnorm Psychol*. 2003;112(3):497–507
27. Whelan R, Conrod PJ, Poline JB, et al; IMAGEN Consortium. Adolescent impulsivity phenotypes characterized by distinct brain networks. *Nat Neurosci*. 2012;15(6):920–925
28. Wilens TE, Biederman J. Alcohol, drugs, and attention-deficit/hyperactivity disorder: a model for the study of addictions in youth. *J Psychopharmacol*. 2006;20(4):580–588
29. Wilens TE, Martelon M, Fried R, Petty C, Bateman C, Biederman J. Do executive function deficits predict later substance use disorders among adolescents and young adults? *J Am Acad Child Adolesc Psychiatry*. 2011;50(2):141–149
30. Volkow ND, Wang GJ, Fowler JS, Ding YS. Imaging the effects of methylphenidate on brain dopamine: new model on its therapeutic actions for attention-deficit/hyperactivity disorder. *Biol Psychiatry*. 2005;57(11):1410–1415
31. Volkow ND, Wang GJ, Kollins SH, et al. Evaluating dopamine reward pathway in ADHD: clinical implications. *JAMA*. 2009;302(10):1084–1091
32. Kalivas PW, Volkow ND. The neural basis of addiction: a pathology of motivation and choice. *Am J Psychiatry*. 2005;162(8):1403–1413
33. Dougherty DD, Bonab AA, Spencer TJ, Rauch SL, Madras BK, Fischman AJ. Dopamine transporter density in patients with attention deficit hyperactivity disorder. *Lancet*. 1999;354(9196):2132–2133
34. Cavacuiti C; American Society of Addiction Medicine. *Principles of Addiction Medicine: The Essentials*. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2011
35. Greenhill LL, Halperin JM, Abikoff H. Stimulant medications. *J Am Acad Child Adolesc Psychiatry*. 1999;38(5):503–512
36. Wilens TE, Adamson J, Sgambati S, et al. Do individuals with ADHD self-medicate with cigarettes and substances of abuse? Results from a controlled family study of ADHD. *Am J Addict*. 2007;16(suppl 1):14–21; quiz 22–23
37. Edwards AC, Kendler KS. Twin study of the relationship between adolescent attention-deficit/hyperactivity disorder and adult alcohol dependence. *J Stud Alcohol Drugs*. 2012;73(2):185–194
38. Biederman J, Petty CR, Wilens TE, et al. Familial risk analyses of attention deficit hyperactivity disorder and substance use disorders. *Am J Psychiatry*. 2008;165(1):107–115
39. Barbaresi WJ, Katusic SK, Colligan RC, Weaver AL, Jacobsen SJ. Long-term school outcomes for children with attention-deficit/hyperactivity disorder: a population-based perspective. *J Dev Behav Pediatr*. 2007;28(4):265–273
40. Bussing R, Mason DM, Bell L, Porter P, Garvan C. Adolescent outcomes of childhood attention-deficit/hyperactivity disorder in a diverse community sample. *J Am Acad Child Adolesc Psychiatry*. 2010;49(6):595–605
41. Fletcher A, Bonell C, Sorhaindo A, Strange V. How might schools influence young people's drug use? Development of theory from qualitative case-study research. *J Adolesc Health*. 2009;45(2):126–132
42. Trenz RC, Harrell P, Scherer M, Mancha BE, Latimer WW. A model of school problems, academic failure, alcohol initiation, and the relationship to adult heroin injection. *Subst Use Misuse*. 2012;47(10):1159–1171
43. Donath C, Grassel E, Baier D, Pfeiffer C, Bleich S, Hillemecher T. Predictors of binge drinking in adolescents: ultimate and distal factors—a representative study. *BMC Public Health*. 2012;12:263
44. Wilens TE, Adamson J, Monuteaux MC, et al. Effect of prior stimulant treatment for attention-deficit/hyperactivity disorder on subsequent risk for cigarette smoking and alcohol and drug use disorders in adolescents. *Arch Pediatr Adolesc Med*. 2008;162(10):916–921
45. Biederman J, Wilens T, Mick E, Spencer T, Faraone SV. Pharmacotherapy of attention-deficit/hyperactivity disorder reduces risk for substance use disorder. *Pediatrics*. 1999;104(2). Available at: www.pediatrics.org/cgi/content/full/104/2/e20
46. Mannuzza S, Klein RG, Truong NL, et al. Age of methylphenidate treatment initiation in children with ADHD and later substance abuse: prospective follow-up into adulthood. *Am J Psychiatry*. 2008;165(5):604–609
47. Murray DW, Arnold LE, Swanson J, et al. A clinical review of outcomes of the multimodal treatment study of children with attention-deficit/hyperactivity disorder (MTA). *Curr Psychiatry Rep*. 2008;10(5):424–431
48. Barbaresi WJ, Colligan RC, Weaver AL, Voigt RG, Killian JM, Katusic SK. Mortality, ADHD, and psychosocial adversity in adults with childhood ADHD: a prospective study. *Pediatrics*. 2013;131(4):637–644
49. Faraone SV, Biederman J, Mick E. The age-dependent decline of attention deficit hyperactivity disorder: a meta-analysis of follow-up studies. *Psychol Med*. 2006;36(2):159–165
50. Warden D, Riggs PD, Min SJ, et al. Major depression and treatment response in adolescents with ADHD and substance use disorder. *Drug Alcohol Depend*. 2012;120(1–3):214–219
51. Sartor CE, Lynskey MT, Heath AC, Jacob T, True W. The role of childhood risk factors in initiation of alcohol use and progression to alcohol dependence. *Addiction*. 2007;102(2):216–225

52. Barbaresi WJ, Katusic SK, Colligan RC, Weaver AL, Jacobsen SJ. Modifiers of long-term school outcomes for children with attention-deficit/hyperactivity disorder: does treatment with stimulant medication make a difference? Results from a population-based study. *J Dev Behav Pediatr*. 2007;28(4):274–287
53. Setlik J, Bond GR, Ho M. Adolescent prescription ADHD medication abuse is rising along with prescriptions for these medications. *Pediatrics*. 2009;124(3):875–880
54. Wilens TE, Adler LA, Adams J, et al. Misuse and diversion of stimulants prescribed for ADHD: a systematic review of the literature. *J Am Acad Child Adolesc Psychiatry*. 2008;47(1):21–31
55. Arria AM, Caldeira KM, O'Grady KE, Vincent KB, Johnson EP, Wish ED. Nonmedical use of prescription stimulants among college students: associations with attention-deficit-hyperactivity disorder and polydrug use. *Pharmacotherapy*. 2008;28(2):156–169
56. White BP, Becker-Blease KA, Grace-Bishop K. Stimulant medication use, misuse, and abuse in an undergraduate and graduate student sample. *J Am Coll Health*. 2006;54(5):261–268
57. Teter CJ, McCabe SE, LaGrange K, Cranford JA, Boyd CJ. Illicit use of specific prescription stimulants among college students: prevalence, motives, and routes of administration. *Pharmacotherapy*. 2006;26(10):1501–1510
58. Boyd CJ, McCabe SE, Cranford JA, Young A. Adolescents' motivations to abuse prescription medications. *Pediatrics*. 2006;118(6):2472–2480
59. Kollins SH. Abuse liability of medications used to treat attention-deficit/hyperactivity disorder (ADHD). *Am J Addict*. 2007;16(suppl 1):35–42; quiz 43–44
60. Musser CJ, Ahmann PA, Theye FW, Mundt P, Broste SK, Mueller-Rizner N. Stimulant use and the potential for abuse in Wisconsin as reported by school administrators and longitudinally followed children. *J Dev Behav Pediatr*. 1998;19(3):187–192
61. McCabe SE, Teter CJ, Boyd CJ. The use, misuse and diversion of prescription stimulants among middle and high school students. *Subst Use Misuse*. 2004;39(7):1095–1116
62. Aldridge AP, Kroutil LA, Cowell AJ, Reeves DB, Van Brunt DL. Medication costs to private insurers of diversion of medications for attention-deficit hyperactivity disorder. *Pharmacoeconomics*. 2011;29(7):621–635
63. Novak SP, Kroutil LA, Williams RL, Van Brunt DL. The nonmedical use of prescription ADHD medications: results from a national Internet panel. *Subst Abuse Treat Prev Policy*. 2007;2:32
64. Wilens TE, Gignac M, Swezey A, Monuteaux MC, Biederman J. Characteristics of adolescents and young adults with ADHD who divert or misuse their prescribed medications. *J Am Acad Child Adolesc Psychiatry*. 2006;45(4):408–414
65. DeSantis AD, Webb EM, Noar SM. Illicit use of prescription ADHD medications on a college campus: a multimethodological approach. *J Am Coll Health*. 2008;57(3):315–324
66. Smith RC, Davis JM. Comparative effects of d-amphetamine, l-amphetamine, and methylphenidate on mood in man. *Psychopharmacology (Berl)*. 1977;53(1):1–12
67. Kollins SH, Shapiro SK, Newland MC, Abramowitz A. Discriminative and participant-rated effects of methylphenidate in children diagnosed with attention deficit hyperactivity disorder (ADHD). *Exp Clin Psychopharmacol*. 1998;6(4):375–389
68. Fredericks EM, Kollins SH. Assessing methylphenidate preference in ADHD patients using a choice procedure. *Psychopharmacology (Berl)*. 2004;175(4):391–398
69. Kollins SH, Rush CR, Pazzaglia PJ, Ali JA. Comparison of acute behavioral effects of sustained-release and immediate-release methylphenidate. *Exp Clin Psychopharmacol*. 1998;6(4):367–374
70. Bright GM. Abuse of medications employed for the treatment of ADHD: results from a large-scale community survey. *Medscape J Med*. 2008;10(5):111
71. Mao AR, Babcock T, Brams M. ADHD in adults: current treatment trends with consideration of abuse potential of medications. *J Psychiatr Pract*. 2011;17(4):241–250
72. Carroll BC, McLaughlin TJ, Blake DR. Patterns and knowledge of nonmedical use of stimulants among college students. *Arch Pediatr Adolesc Med*. 2006;160(5):481–485
73. Collett BR, Ohan JL, Myers KM. Ten-year review of rating scales. V: scales assessing attention-deficit/hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry*. 2003;42(9):1015–1037
74. Levy SJ, Kokotailo PK; Committee on Substance Abuse. Substance use screening, brief intervention, and referral to treatment for pediatricians. *Pediatrics*. 2011;128(5). Available at: www.pediatrics.org/cgi/content/full/128/5/e1330
75. National Institute of Health, Office of Extramural Research. Grants & funding, funding opportunities & notices search results, April 22, 2011. Available at: http://grants.nih.gov/grants/guide/search_results.htm?text_curr=niaaa&scope=rfa&year=active&sort=rel&text_prev=&Search.x=26&Search.y=4. Accessed November 13, 2012
76. National Institute on Drug Abuse (NIDA). Funding application—request for applications. Available at: www.drugabuse.gov/funding-app/rfa. Accessed November 13, 2012
77. Dupont RL, Coleman JJ, Bucher RH, Wilford BB. Characteristics and motives of college students who engage in nonmedical use of methylphenidate. *Am J Addict*. 2008;17(3):167–171
78. Mariani JJ, Levin FR. Treatment strategies for co-occurring ADHD and substance use disorders. *Am J Addict*. 2007;16(suppl 1):45–54; quiz 55–56
79. Faraone SV, Glatt SJ. A comparison of the efficacy of medications for adult attention-deficit/hyperactivity disorder using meta-analysis of effect sizes. *J Clin Psychiatry*. 2010;71(6):754–763
80. Jasinski DR, Krishnan S. Abuse liability and safety of oral lisdexamfetamine dimesylate in individuals with a history of stimulant abuse. *J Psychopharmacol*. 2009;23(4):419–427
81. Elbe D, Macbride A, Reddy D. Focus on lisdexamfetamine: a review of its use in child and adolescent psychiatry. *J Can Acad Child Adolesc Psychiatry*. 2010;19(4):303–314

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